DOCKET FILE COPY ORIGINAL



Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

| | | |
|---|---|---|
| In the Matter of an inquiry into | ) | |
| AM Radio Service Directional | ) | MM Docket No. 93-177 |
| Antenna Performance Verification | ) | |

COMMENTS OF JOHN FURR & ASSOCIATES, INC (JF&A)

To: The Commission

John Furr & Associates, Inc. ("JF&A") hereby submits is comments, in response to the Commission's Notice of Inquiry, released June 29, 1993. As communications consultants, the staff of JF&A has experience in communications allocations which extends for more than 25 years.

(a) Instrumentation

The antenna monitor should be the primary source of antenna parameters. Once in adjustment, the monitor provides a reliable system whether the sample is made by loop or torrid coil. However, our experience shows that the torrid coil leads to erroneous adjustments when used as an initial tuning instrument whereas the loop has proven to be quite reliable.

Thermocouple ammeters now available to measure base currents have are not as reliable as those previously available. All base ammeters suffer the same error problems that torrid loops in that they measure all current to the antenna, whether radiated or passed through equipment mounted across the base insulator (lighting chokes, isso-couplers, etc). As a result, base ammeters should no longer be required. With more research, voltage sampling should be considered as an option to determining antenna parameters.

The current system of locating the monitor at the transmitter (point of adjustment) and the sampling on the output of the coupling unit/antenna is appropriate. Monitor points which are checked by use of field meters should continue. This documentation should be made and records kept based only on the requirement of the system to maintain licensed parameters. The Commission should be informed whenever it requests that data be submitted.

The transmitting rules about construction also need to be addressed as relates to these measurement systems. Negative towers (those who return power to the transmitter) should be allowed to be terminated into a dummy load, which will result in a broader bandwidth operation. These losses can be measured with an ammeter and the power of the transmitter increased to compensate for these resistive losses.

## (b) Making Measurements

The rules pertaining to establishing inverse distance field (IDF) and conductivity through graphical analysis should be retained for these purposes. These are useful in allocation studies which allow flexibility over the M-3 allocation map.

For the purpose of establishing a directional antenna, the graph of Figure 8 should be used for the reference non-directional IDF. Proofs submitted to the FCC (with FCC Form 302) should no longer analyze the IDF by graphical means. Analysis should be done only by mathematical ratio (DA measurements to Non-DA measurements), just as partial proofs are done and accepted. There should be some attention to a circularity test, maybe analyzed by distance times field, to insure that the non-directional antenna is sufficiently circular in nature, at least in the order of 20 percent.

Non-directional measurements and directional measurements should be made on the null radials only. If the transmitter is producing the appropriate power and the nulls are adjusted properly, no other radials are necessary. A distance from 3 to 16 kilometers is sufficient. Market place forces will also provide the funding and effort to see that an antenna meets RMS minimums without having to rely on expensive measurements for proof to the Commission.

Maps would still be required to locate points and these original maps should be retained by the licensee for future measurements. However, the maps should not be submitted with the proof. Often times the metropolitan areas change radically over the years and the maps on file bear no resemblance to the real area. Monitor points should be established in the same manner as present. This is the only means that another station or the Commission can have to test a station for compliance thus insuring protection without access to the transmitting stations monitoring equipment.

The repeatability of readings of monitor points should not exceed 10 percent over the standard pattern's maximum. Often, due to urban changes and re-radiation, a radial may not always maintain its level where no changes have occurred in the transmitting system. An additional change in field will not result in excessive interference in the real world.

In the book, Electronic Measurements by Terman and Pettit (McGraw-Hill, 1952), Terman states (Page 461):

> "If careful attention is paid to details, it is generally possible to determine the field strength with an error which does not exceed 10 to 25 percent (that is 1 to 2 dB). The inherent accuracy obtainable by the different methods of measuring field strength is about the same. .... A detailed study* of the accuracy of field-strength measuring equipment designed for use at standard broadcast frequencies (500-1600

kc), shows that they typical error is about 20 percent. However, when care is taken to minimize all sources of error, it is possible to hope for an accuracy of 5 percent or better. ..."

(*Diamond, Norton and Lapham, On the Accuracy of Radio Field Intensity Measurement at Broadcast Frequencies, J. Research Natl. Bur. Standards, vol 21, p 795, Dec. 1938).

## (c) Theoretical verses Measured

As was mentioned in the first section, some sample systems will not return accurate indications relating to actual field radiated. The FCC has access to its files in the lists of directional antenna licenses which list the theoretical and indicated parameters. It would be interesting for the Commission to report the error average for the currently licensed systems. One system currently used in this office to find the needed antenna parameters is to set a new system to theoretical. The radials are partially sampled and ratioed. Then a design program is used to calculate what parameters are theoretically required to achieve the measured result. The new theoretical numbers are then applied as a correction factor to determine the final numbers. Usually the measured pattern results immediately with this method.

We have little experience using Mini-NEC as an analyzing tool for antenna adjustments. We understand from those who have, that a voltage standard (verses a current standard) may result in accurate antenna adjustments that may negate the need for measurements to show compliance. However, the proof of compliance will always require on-site access, as opposed to access to outside monitoring points.

## (d) Re-radiation Considerations

Allowances can be made for re-radiation, especially when measured fields are used for compliance proof. Far field points are expensive to establish and are rarely needed for proof. However, a licensee could, at some future time, supplement readings on troublesome null radials by adding information beyond the effect of the re-radiation structure to show compliance. In these cases, the proof would be taken from only the far field points rather than an entire radial average.

October 26, 1993

John R. Furr, President

Larry Tschirhart, Associate